

5 WHAT IS CLAIMED IS:

1. A single phase, energy curable varnish composition comprising:
  - (a) water soluble ethylenically unsaturated reactive oligomers and monomers;
  - (b) water insoluble ethylenically unsaturated reactive oligomers and monomers; and
  - (c) a resin selected from the group consisting of a water soluble non-reactive resin, a water insoluble acid or base functional resin and water insoluble ethylenically unsaturated reactive resin, wherein said water insoluble resins contain acid functional groups.

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2. The varnish composition of claim 1, wherein the amount of water soluble ethylenically unsaturated reactive oligomers and monomers present is between 30 and 85 parts.

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3. The varnish composition of claim 1, wherein the amount of water insoluble ethylenically unsaturated reactive oligomers and monomers is between 10 and 45 parts.

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4. The varnish composition of claim 1, wherein the amount of the acid functional groups in the water insoluble resins is about 5 to 25 parts.

5. The varnish composition of claim 1 when present in a lithographic printing ink composition, renders the ink composition water washable before curing and water resistant after curing.

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6. The varnish composition of claim 1, wherein the water soluble oligomer is selected from the group consisting of an acrylate oligomer, a methacrylate oligomer and a combination thereof.

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7. The varnish composition of claim 6, wherein the acrylate oligomer is selected from the group consisting of epoxy acrylate, epoxy methacrylate, polyether acrylate, polyether methacrylate, polyester acrylate, polyester methacrylate, polyurethane acrylate, polyurethane methacrylate, melamine acrylate, melamine methacrylate, polyethylene glycol diacrylate and polyethylene glycol dimethacrylate oligomers.

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8. The varnish composition of claim 1, wherein the water soluble oligomer contains two or more acrylate oligomer groups or methacrylate oligomer groups.

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5        9.      The varnish composition of claim 8, wherein the acrylate and  
methacrylate oligomers are epoxy acrylate and epoxy methacrylate oligomers,  
respectively.

10       10.     The varnish composition of claim 1, wherein the water soluble,  
ethylenically unsaturated oligomer contains carboxylic acid groups, acrylic  
groups, methacrylic groups, polyamide resins, acrylic resins, acrylated acrylic  
resins, amino resins, polyester resins, urethane resins, starch, polysulfonate  
resins, phenolic resins and melamine resins or a combination thereof.

15       11.     The varnish composition of claim 1, wherein the water insoluble  
ethylenically unsaturated oligomer contains aromatic resins, phenol  
formaldehyde resins, melamine resins, hydrocarbon resins and rosins, or a  
combination thereof.

20       12.     An energy curable, water washable printing ink composition suitable  
for waterless lithographic printing comprising:

- (a)    water soluble ethylenically unsaturated reactive oligomers and  
monomers;
- (b)    water insoluble ethylenically unsaturated reactive oligomers and  
monomers;
- (c)    a resin selected from the group consisting of a water soluble non-  
reactive resin, a water insoluble acid or base functional resin and  
water insoluble ethylenically unsaturated reactive resin, wherein  
said water insoluble resins contain acid functional groups; and
- 30       (d)    a pigment.

wherein said printing ink composition is water washable before curing and  
water-resistant after curing.

35       13.     The printing ink composition of claim 12, wherein the amount of  
water soluble ethylenically unsaturated reactive oligomers and monomers present  
is between 30 and 85 parts.

40       14.     The printing ink composition of claim 12, wherein the amount of  
water insoluble ethylenically unsaturated reactive oligomers and monomers is  
between 10 and 45 parts.

45       15.     The printing ink composition of claim 12, wherein the amount of the  
acid functional groups in the water insoluble resins is about 5 to 25 parts.

16.     The printing ink composition of claim 12 being water washable  
before curing and water resistant after curing.

5        17. The printing ink composition of claim 12, wherein the pigment is  
selected from the group consisting of monoazo yellow, monoarylide yellow,  
diarylide yellow, naphthol red, rubine red, lithol rubine, phtalocyanine blue,  
carbon black, Pigment Yellow 1, Pigment Yellow 3, Pigment Yellow 12, Pigment  
10      Yellow 13, Pigment Yellow 14, Pigment Yellow 17, Pigment Yellow 63, Pigment  
Yellow 65, Pigment Yellow 73, Pigment Yellow 74, Pigment Yellow 75, Pigment  
Yellow 83, Pigment Yellow 97, Pigment Yellow 98, Pigment Yellow 106, Pigment  
Yellow 114, Pigment Yellow 121, Pigment Yellow 126, Pigment Yellow 127, Pigment  
Yellow 136, Pigment Yellow 174, Pigment Yellow 176, Pigment Yellow 188, Pigment  
Orange 5, Pigment Orange 13, Pigment Orange 16, Pigment Orange 34, Pigment Red  
15      2, Pigment Red 9, Pigment Red 14, Pigment Red 17, Pigment Red 22, Pigment Red  
23, Pigment Red 37, Pigment Red 38, Pigment Red 41, Pigment Red 42, Pigment Red  
57:1, Pigment Red 112, Pigment Red 170, Pigment Red 210, Pigment Red 238,  
Pigment Blue 15, Pigment Blue 15:1, Pigment Blue 15:2, Pigment Blue 15:3,  
Pigment Blue 15:4, Pigment Green 7, Pigment Green 36, Pigment violet 23,  
20      Pigment Black 7, and Clariant® GDR Pigment Yellow 11-025.

19. An energy curable, water washable printing ink composition suitable  
for waterless lithographic printing comprising:

- (a) between about 30 and 85 parts of a water soluble ethylenically unsaturated reactive oligomers and monomers;
- (b) between about 10 and 45 parts of a water insoluble ethylenically unsaturated reactive oligomers and monomers;
- (c) a resin selected from the group consisting of a water soluble non-reactive resin, a water insoluble acid or base functional resin and water insoluble ethylenically unsaturated reactive resin, wherein said resin contains between about 5 to 25 parts of acid functional groups; and
- (d) a pigment.

wherein said printing ink composition is water washable before curing and  
35      water-resistant after curing.

20. A method of preparing an energy curable, water washable printing ink composition suitable for the waterless lithographic printing comprising mixing:

- 40      (a) water soluble ethylenically unsaturated reactive oligomers and monomers;
- (b) water insoluble ethylenically unsaturated reactive oligomers and monomers;
- (c) a resin selected from the group consisting of a water soluble non-reactive resin, a water insoluble acid or base functional resin and water insoluble ethylenically unsaturated reactive resin, wherein  
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5               said water insoluble resins contain acid functional groups; and  
      (d)      a pigment.

wherein said printing ink composition is water washable before curing and  
water-resistant after curing.

10             21. A method of preparing an energy curable, water washable printing  
ink composition suitable for the waterless lithographic printing comprising  
mixing:

- (a)    between about 30 and 85 parts of a water soluble ethylenically  
        unsaturated reactive oligomers and monomers;
- (b)    between about 10 and 45 parts of a water insoluble ethylenically  
        unsaturated reactive oligomers and monomers;
- (c)    a resin selected from the group consisting of a water soluble non-  
        reactive resin, a water insoluble acid or base functional resin and  
        water insoluble ethylenically unsaturated reactive resin, wherein  
20               said water insoluble resins contain between about 5 to 25 parts of  
        acid functional groups; and
- (d)    a pigment

wherein said printing ink composition is water washable before curing and  
water-resistant after curing.

25             22. A method of waterless lithographic printing comprising using an  
energy curable, water washable printing ink composition which comprises:

- (a)    water soluble ethylenically unsaturated reactive oligomers and  
        monomers;
- (b)    water insoluble ethylenically unsaturated reactive oligomers and  
        monomers;
- (c)    a resin selected from the group consisting of a water soluble non-  
        reactive resin, a water insoluble acid or base functional resin and  
        water insoluble ethylenically unsaturated reactive resin, wherein  
35               said water insoluble resins contain acid functional groups; and
- (d)    a pigment.

wherein said printing ink composition is water washable before curing and  
water-resistant after curing.

40             23. A method of waterless lithographic printing comprising using an  
energy curable, water washable, printing ink composition which comprises:

- (a)    between about 30 and 85 parts of a water soluble ethylenically  
        unsaturated reactive oligomers and monomers;
- (b)    between about 10 and 45 parts of a water insoluble ethylenically  
        unsaturated reactive oligomers and monomers;
- (c)    a resin selected from the group consisting of a water soluble non-

- 5           reactive resin, a water insoluble acid or base functional resin and  
water insoluble ethylenically unsaturated reactive resin, wherein  
said water insoluble resins contain between about 5 to 25 parts of  
acid functional groups; and
- (d)    a pigment
- 10   wherein said printing ink composition is water washable before curing and  
water-resistant after curing.